the Darwinian theory is alluded to, and the word "fitness" (Zweckmässigkeit) is defined, with regard to life, as that which increases its duration. And "fitness" consists in the organism being provided with means for spreading, by multiplication, over a wide area, and in its possessing a large store of energy. These conditions are fully discussed in a most suggestive manner. Passing on to the nerves and their functions, it is noticed that the transfer of energy through a nerve is not dependent on the nature of the stimulus which is applied; thus a mechanical, electrical or chemical stimulus, that is, the expenditure of any one of these varieties of energy, is equally effective in causing a flow of energy through a nerve. Ostwald therefore throws out the suggestion that a special form of energy must be associated with all nerve-processes, which he terms "nerve-energy." He regards it as probable that the passage of energy in a nerve is due to the presence of catalysers, which are brought into action by the nerve-energy; these are partly destroyed by their action, so that the nerve fails to respond after it has undergone excess of stimulation. But with rest the catalysers are replaced in even greater amount than originally, and the nerve gains power by use. Organisms, in general, store energy in a chemical form, and their chief function is the conversion of this chemical energy into other forms. As a means of effecting this change they employ catalysers in order to accelerate useful changes and to retard those which are baneful. Closely connected with this idea is memory, which, according to E. Hering, may be defined as that property of living substance by means of which processes which take place in them leave effects which are favourable to the repetition of such processes. Without insisting on the justice of his suggestions, Ostwald adduces a number of chemical processes in which repetition renders the chemical change easier and more rapid.

Passing next to the consideration of the life of the soul or intellect (das geistige Leben), Ostwald takes the view that in all intellectual processes another kind of energy takes part, which he terms "spiritual" (geistige) energy. He is disposed to regard this as identical with nerve-energy, and consciousness is a property of this form of energy when its seat is the brain. Again he illustrates by an analogy; extension in space is a sign of mechanical energy and duration in time of energy of motion. Indeed, he surmises that as the processes of consciousness are themselves associated with a special kind of energy, our views of external nature are therefore legitimately energetic. One is reminded, however, of Dr. Johnson's dictum, "Who drives fat oxen must himself be fat"; at all events the idea is an ingenious one. Consciousness need not always, however, be associated with the occurrence of a process involving nerve-energy; while we have conscious impressions, conscious thoughts and conscious acts, these may also occur unconsciously. It must be admitted that some explanation is required of unconscious thought; anyhow, the author makes out a fair case for the belief.

To follow the author in his discussion of personality, of will and its freedom, of pleasure and pain, of art, of music and of goodness would occupy much space. I hope that even the very imperfect sketch which has been attempted will prove sufficient to induce students both of science and of philosophy to read for themselves this interesting work, and to examine, without prejudice, Ostwald's interpretation of the facts of Nature.

W. R.

THE CIVILISATIONS OF THE OLD AND NEW WORLDS.

The Fundamental Principles of the Old and New World Civilisations. By Zelia Nuttall. Being the second volume of the *Archaeological and Ethnological Papers of the Peabody Museum.* Pp. i+602. (Cambridge, Mass.; London: Quaritch; Leipzig: Hiersemann, 1901.)

THE interesting volume before us is, we believe, the first which any writer has devoted to a careful study of the common principles which underlie the civilisations of Egypt, Babylonia, Mexico and Europe, and as such it merits much consideration at the hands of ethnographers and anthropologists, and of students of religion in general. Much is known about European civilisation, both in its early and middle forms, and something is known of the great civilisations of Babylonia (Sumerian) and of Egypt, but Mrs. Nuttall, in bringing together the results obtained from the study of these subjects during recent years, and in putting them into line with a new group of results obtained from an examination of the Mexican inscriptions at first hand, has done a piece of good and useful work which will be appreciated by all serious students of the beliefs of primitive man. The books which have appeared in Europe and America on early symbolism and cognate subjects are many, but in most of them the writers have confounded what ought to have been kept apart, and owing to a want of groundwork of facts have been led to make nebulous theories which have earned for their authors the ridicule of the trained investigator of such subjects. There is no study more fascinating than that which results in the bringing together of the facts which are common to all great civilisations from China to Mexico, and there is probably none in which so many men have gone astray; every earnest worker knows why this has happened and deplores the publication of books and articles by faddists and others which will obscure the true light.

Mrs. Nuttall's work may be conveniently divided into three sections, which deal with the civilisations of America, Asia and Europe respectively, and these are followed by a fourth section, which treats of civilisations in general; the remainder of the book contains three appendices and an index. As was to be expected, nearly one-half of the volume is devoted to the description of American civilisation, and it is this section in which the archæologist will probably be most interested. Originally the author intended to produce a short monograph of forty-one pages, which treated of the origin of the native swastika or cross symbols, but having actually written the monograph she arrived at the conclusion that the cosmical conceptions of the ancient Mexicans were identical with those of the Zuñis. It was next clear to her that the same fundamental ideas were to be found in Yucatan, Central America and Peru, and the natural result of her investigations into them was that Mrs. Nuttall's monograph of forty pages grew into one of 284 pages, and that then she found a course of comparative studies would be necessary if the best use was to be made of her previous labours. Unfortunately, Mrs. Nuttall began to print before she realised the magnitude of the task which she had undertaken, and it was impossible, therefore, for her to avail herself of the results of the study of symbols, &c., given by the late Mr. John O'Neil in his "Night of the Gods," by Mr. Elworthy in his work on the "Evil Eye," and by Mr. Frazer in his "Golden Bough." There is, however, little cause to regret this, for by works of this kind Mrs. Nuttall would certainly, though unconsciously, have been influenced, and it is probable that she might have been tempted to modify some of her views as the result; but as it is we have her unbiased opinions placed before us, and this is what is wanted at this stage of the study of primitive beliefs and symbolism. Many years must elapse before the final work can be written on these subjects, for all the materials upon which it must be based have not yet been collected, and until this is done it is futile to attempt to deduce the "conclusion of the matter."

Starting with the discovery that the great Mexican god Tezcatlipoca was identical with Mictlantecuhtli, and that having been overthrown by Huitzilopochtli he arose and transformed himself into the constellation of Ursa Major, Mrs. Nuttall goes on to show by a series of cuts that the constellation of Ursa Major furnished the archetype of the different forms of the swastika and cross symbols. The next point to determine was at what epoch the swastika was used as a symbol, and this Mrs. Nuttall decides could not have been before Ursa Major became circumpolar, *i.e.* about B.C. 4000.

"At that period, when Draconis was the Pole-star, the circle described about it by Ursa Major was considerably closer than it is at present" (p. 21).

At a very early period, Mrs. Nuttall thinks, Polaris came to be regarded as an immutable centre of axial energy, and in process of time as the symbol of the Creator of the universe. The rotary motion of Ursa Major was next observed carefully, and eventually the different positions of the constellation became associated with the seasons, and the swastika was commonly employed as the sign for year, or for a cycle of time.

But besides the swastika another calendar sign is known, *i.e.*, that which is a representation of the night of the winter solstice, the well-known triskelion; examples of the swastika are common among the ancient Mexicans, while of the triskelion there are none. The constellations of Ursa Major and Ursa Minor each contain seven stars, and this mystical number appears in the seven tribes of the ancient Mexicans who traced their origin to seven caves situated in the north, and in the seven parts into which Cosmos was divided. The first of Cosmos, or fixed centre, was Polaris, creative, generative and ruling power of the universe; its Four Quarters were associated with the elements and were ruled by the central force, and the ideas of Above and Below, which are found in Egyptian and other ancient languages, were suggested by the rising and setting of celestial bodies.

The Mexican religion being of a character so decidedly astronomical, it follows that everything connected with the worship of the great god would partake of the same nature; pyramids and temples were just as much astronomical observatories as houses of God, and their construction was planned accordingly. The people who held the views described above believed that they were descended from star deities, and they had a legend that the goddess "Starry Skirt," having been united to "Shining Star," gave birth to a flint knife, called Tecpatl. Their other children were startled at this, and, seizing the flint knife, hurled it to the earth, when it broke into pieces at the "Seven Caves" and produced 1600 gods and goddesses. It is worthy of note in connection with this that the flint knife was called the son of Cihuacoatl, the earth-mother. As befitted a religion which was based upon the cult of the night sky, at least one-half of the ceremonies were performed during the night; the sacred fire burnt by day and by night, and was only allowed to go out once every fifty-two years. But it was rekindled at midnight precisely.

We regret that we cannot follow Mrs. Nuttall step by step through her deductions from the Mexican picture signs and her description of primitive customs and beliefs as illustrated by them, for to do so would require the space allowed for several articles; the reader must do this for himself, and we are justified in saying that he will be rewarded for his pains if he does so. The astronomical origin of nearly every habit and custom of the ancient Mexican is clearly traced, and the relative position of the sexes in the State, as well as the classification of the people for administrative purposes, are well delineated; in short, what Mrs. Nuttall has given us is a detailed history of the ancient Mexican and his civilisation. The references to inscriptions throughout the work prove that she is familiar with what is known of the meaning of Mexican picture signs, and many of her facts are based upon the results given by Mr. Alfred Maudslay, but we are glad to see that whilst Mr. Le Plongeon is quoted at times, Mrs. Nuttall does not in any way identify herself with his wild views about the Maya language.

Passing from American to Chinese civilisation, Mrs. Nuttall has collected a large number of notes and passages from which it is seen that the Chinese held views about Ursa Major, the Four Quarters of Heaven, the Above and the Below, &c., very like those which were held by the ancient Mexicans, and it is remarkable how close is the similarity between the habits and customs and religion of the two peoples in certain respects. The really interesting point in connection with such similarity is to account for its existence; at present it is impossible to do this, and we do not see that the difficulty is in any way lightened by the theory which makes the Chinese to come originally from Babylonia, which country the emigrants are said to have abandoned when Kutir-Nakhkhunte conquered Babylon, B.C. 2295. The identity of Chinese and Akkadian has not been demonstrated to the satisfaction either of Chinese or Akkadian scholars in general, although it was fashionable some few years ago to declare that the two languages were one and the same tongue; the theory was not entertained by any except Chinese scholars who knew no Akkadian, or by men who knew a little Akkadian but had no knowledge of Chinese. The remarks on the entrance of Buddhism into China in the first century of our era are to the point, and the extracts from the famous bilingual Syriac and Chinese inscription (p. 304) at Singanfu which Mrs. Nuttall quotes contain interesting confirmation of her views of the Christian cross being originally related to the swastika. The Chinese, taking this view, naturally called the Christians "Cross-worshippers." In Japan and India Mrs. Nuttall has found many parallels, and in Mesopotamia to this day the men of Saba appear to worship the Pole-star. The religious literature of ancient Babylonia and Assyria contains many passages which prove that the Semites who employed the cuneiform character held many views in common with the Mexicans; while an elaborate examination of Egyptian works has provided Mrs. Nuttall with a large number of proofs that in Mexico, China, and Egypt the views held in respect of certain astronomical phenomena were identical.

One of the most interesting sections of the book before us is that which treats of civilisations in general, and which contains Mrs. Nuttall's general summary and conclusions about the meaning of the facts which she has so diligently compiled. To detail these would greatly lengthen an article which is already inordinately long, and the reader will, no doubt, prefer to peruse these for himself; but we may briefly point out that the central idea of the work is that the swastika, which was first employed as a year sign, became later the symbol of the Four Quarters, of quadruplicate division, and of a stable central power, whose rule extended in four directions and controlled the entire Heaven. Human society was divided into four groups, and territorial organisations were formed in four parts. Early civilisations were founded on astronomical principles, on which also rested the worship of the gods. In the case of America, certain elements of culture are assumed to be due to "Mediterranean seafarers" and to transported refugees and would-be colonists; the basis, however, of both foreign and native civilisations was the recognition of immutable laws governing the universe, "attained, by both races, by long-continued observation of Polaris and the 'northern' constellations." The use of Mrs. Nuttall's volume is much facilitated by the excellent index, which fills thirty-four pages of matter printed in double columns in small type, and which merits great praise. We could have wished that a bibliography had been added and more references to the public literature of early symbolism; to say this is not to detract from the commendation which the book justly deserves, for a classified list of authorities could be compiled from Mrs. Nuttall's notes, and it would be useful to everybody interested in the subject.

GEOMETRY—NOT IN EUCLID'S ORDER.

Primer of Geometry, comprising the Subject-Matter of Euclid I.-IV., treated by the Methods of Pure Geometry. By H. W. Croome Smith, B.A. Pp. xvi + 100. (London: Macmillan and Co., Ltd., 1901.) Price 2*s.*

THIS little book is another attack on Euclid, and its main object is to exhibit an elementary course of geometry in a system of natural sequence—Euclid's order and method being, of course, ignored. Although in the preface the author adopts a severely logical style and successfully maintains a strong case against our conservative Euclidians, it seems to us that in one respect he is in error. His work is divided into three chapters, headed "Straight Lines and Rectilineal Figures," "The Circle," and "Areas." In the first chapter no mention of a circle occurs, and the author taxes Euclid with an illogical mode of procedure in the following words:—

> "It is at least questionable logic to make use of the circle in the early stages, and subsequently to use the properties thus demonstrated of lines, angles, &c., in demonstrating the properties of the circle."

Justice to Euclid compels us to maintain that this charge is substantially unjust, because the only use made by him of the circle in the early stages (Book I. of Euclid) relies on the facts that the radius is a line of constant length, and (in prop. xii. of Book I.) that if a circle cuts a right line once, it will cut it again. No one can quarrel justly with these assumptions, or can seriously describe them as involving "properties" of the circle which require antecedent demonstration. When criticising Euclid, we must remember that geometry is not wholly a system of pure or formal logic—it implies the sense of sight, sensuous intuition in space.

One disadvantage of ignoring the circle wholly in the early stages, as is done by Mr. Croome Smith, is that we get into serious difficulties with regard to the conception and measurement of *angles.* He identifies an angle with "change in direction"—"this *change in direction*, which has nothing to do with the length of the line, is what we mean by *angular magnitude*" (p. 6); "the angle is *measured* by the amount of revolution of a straight line when turned about the vertex in the plane of the lines from the one to the other." True; but how are we to get a quantitative meaning of the word "revolution" itself? It is, without the aid of the conception of a divided circle, or of a system of superposition, just as vague and undefined as Euclid's own term "inclination." It appears to us that Mr. Croome Smith wrestles vainly with a definition of a right angle on p. 7. He imagines a right line OA to revolve round O into the position OB, which is OA reversed, and he says,

> "in the position OC, midway between OA and OB in the course of its revolution, the turning line makes with OA or OB an angle which is half the preceding angle: such an angle therefore is also an angle of *constant* magnitude, and is called a right angle."

In this definition there is one little word—"midway"—the precise meaning of which we should wish to know. We fear that it is hopelessly vague without the notion of a circular protractor, or something more than the author is willing to give us. Hence we think that his definition of an angle and his method of measuring angular magnitude are not successful.

Nevertheless, criticism of this kind must not condemn a book which has several merits. A judicious teacher will always be able to supplement imperfect definitions. There is, perhaps, far too much straining after completeness of definition and verbal exactness in writers on geometry; for some of the most simple notions in the subject are things which cannot be defined with absolute accuracy, and the writer as well as the teacher must take it for granted that the pupil has already an adequate notion of the thing described—*e.g.*, a point, a right line, a plane surface.

Mr. Croome Smith rightly discards Euclid's limitation